

Firm Leverage, Labor Market Size, and Employee Pay

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Abstract

We provide new estimates of the wage costs of firms' debt using an empirical approach that exploits within-firm geographical variation in workers' expected unemployment costs due to variation in local labor market in a large sample of public firms. We find that, following an increase in firm leverage, workers with higher unemployment costs experience higher wage growth relative to workers at the same firm with lower unemployment costs. Overall, our estimates suggest wage costs are an important component in the overall cost of debt, but are not as large as implied by estimates based on ex post employee wage losses due to bankruptcy; we estimate that a 10 percentage point increase in firm leverage increases wage compensation for the median worker by 1.9% and total firm wage costs by 17 basis points of firm value.

Keyword:

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A large literature is dedicated to estimating the benefits and costs of corporate debt, including tax benefits, bankruptcy costs, agency benefits and costs, and other costs of financial distress. More recently, this research has focused on estimating the costs of debt, or leverage, arising from changes in rank-and-file employee behavior in response to changes in firms' capital structures. For example, Chang (1992), Jaggia and Thakor (1994) and Berk, Stanton and Zechner (2010) show theoretically that, in the presence of costs to employees when firms enter financial distress, employees may demand *ex ante* higher wages to compensate for such risk as firms increase their leverage. This, in turn, may limit the amount of debt that firms issue.

Estimating the effect of firm leverage on employee wages is challenging for several reasons. First, firms may endogenously choose their capital structures in response to wage costs. In particular, if firms need to compensate individuals for unemployment risk, optimal leverage ratios could be lower than if workers do not demand compensation. Second, omitted variables such as the marginal product of labor could lead to biased estimates. For instance, firms may issue equity to finance new investment in labor-augmenting technology. As a result, leverage ratios decrease and, because the marginal product of labor increases, wages will likely increase. Third, in many datasets one cannot observe individual employee's wages or other characteristics, but rather only a total wage bill of the firm which could also be influenced by changes in worker composition. Thus, the estimated relationship between changes in leverage and employee pay could be biased; for example skilled workers earning higher wages may leave and be replaced with lower-skill, and lower-paid, workers given an increase in firm leverage.

In our paper, we provide estimates of the wage costs of firm debt in a broad sample of publicly traded U.S. firms over the period 1991 to 2008 using an approach that addresses the above concerns by using matched firm-worker-level data from the Census Bureau's Longitudinal Employer-Household Dynamics (LEHD) program to exploit within-firm variation in employees' expected costs of unemployment. Expected unemployment costs may vary across

workers within the same firm due to geographical differences in labor search and matching frictions. Therefore, when a firm increases its leverage, workers with higher expected unemployment costs should demand a higher wage premium than other workers. By exploiting within-firm variation in expected unemployment costs, we are able to account for firm-level shocks that determine firm leverage. Likewise, we are also able to control for individual worker characteristics that could influence their wages and the possible confounding effects of shifts in worker composition over time. Additionally, our analysis of a broad sample of U.S. firms also allows us to obtain estimates of the wage costs of debt that are more generalizable than those that are focused on particular subsamples of firms, such as those in financial distress (e.g., Graham, Kim, Li, and Qiu (2016)) or those engaged in bargaining with unions (e.g., Matsa (2010)) and provide large-scale estimates of the ex ante, rather than ex post, wage costs associated with an increase in firm leverage.

Our primary measure of a worker’s expected unemployment costs is the relative size of the individual worker’s labor market, which we calculate as the industry share of MSA employment relative to the industry share of national employment. This measurement choice is informed by the literature on job search which finds evidence of economies of scale in labor markets. For example, Petrongolo and Pissarides (2006) find that, individuals in larger labor markets have significantly higher reservation wages during unemployment and earn significantly higher wages following unemployment than those in smaller labor markets. Helsley and Strange (1990) and Bleakley and Lin (2012) also document a negative relationship between labor market size and unemployment.

We provide empirical justification of our formulation of labor market size as a measure of expected unemployment costs; in particular, we find that individuals in larger labor markets experience smaller declines in earnings following firm closures than individuals in smaller labor markets. In addition to capturing meaningful variation in unemployment costs, this measure of labor market size permits the inclusion of MSA-year fixed effects to control for local economic shocks, unlike MSA-level measures of labor market size. We also find that our

results are robust to alternative measures of labor market size and to alternative measures of unemployment costs.

Turning to our main results, we find that, within a firm, wages for employees in smaller labor markets grow faster than other employees at the firm in response to an increase in firm leverage. The estimates imply that, in response to a 10 percentage point increase in leverage, employees in small labor markets earn a wage premium of 0.2% relative to employees who work at the same firm but in large labor markets.¹ We then use this cross-sectional result to estimate the effect of firm leverage on employee pay. To do so, we assume that workers in the largest labor markets require a certain wage premium for firm leverage. To create a lower bound estimate, we assume that these workers require no wage premium in return for higher firm leverage. We then use our estimate to calculate how a 10 percentage point increase in leverage affects the pay for each employee at the firm on the basis of the size of the labor market in which they work. Finally, we aggregate these employee-specific estimates to the firm level. This calculation suggests that a 10 percentage point increase in leverage increases compensation for the median worker by about 1.9% and total employee compensation at the firm by approximately 17 basis points of firm value, implying that labor costs are an important consideration for firms when choosing their capital structure.

We then examine whether certain types of employees demand greater compensation for increases in firm leverage vis-à-vis other employees. For employees to be compensated for greater unemployment risk due to higher leverage, these employees need to understand the effect of firm leverage on unemployment risk and they need sufficient bargaining power. We find evidence that both factors are important determinants of wage changes in response to changes in firms' leverage. First, the wage response is stronger for workers likely to understand the relationship between leverage and unemployment; employees with higher wages and employees with exposure to previous bankruptcies experience higher wage increases in response to increases in firm leverage. Second, we find the wage response to changes in firm

¹We define small labor markets as equal to the 25th percentile in size and large labor markets as equal to the 75th percentile in size.

leverage is stronger in more competitive labor markets and markets with low unemployment, environments in which employees likely have greater bargaining power with their employers. We also find that the effect of leverage on wages is stronger amongst new employees, who are also more likely to negotiate wage increases vis-à-vis continuing employees.² We find that, among new employees at a given firm, a 10 percentage point increase in leverage leads new employees in small labor markets to earn approximately 0.5% more than new employees in larger labor markets, double the effect estimated across all workers at firms.

Finally, we consider explanations for our empirical results that may bias our main estimates of the wage costs of leverage. We first examine the possibility of reverse causality, where increasing employee wages lead firms to increase leverage. If this were the case, we would expect to find a significant relationship between employee wage growth in the years preceding a change in leverage and the interaction of changes in firm leverage and labor market size in the years. Contrary to this expectation, we only find a significant relation for wage growth in the year following the change in leverage. We also find no evidence that the results are due to an unobserved productivity shock. To rule out this explanation, we study within-firm variation in growth rates across MSAs. If our results are due to a localized productivity shock, we would expect the establishments benefitting from positive shocks to grow faster than the firm's other establishments. We find no evidence of differential effect on growth rates in employment, establishment counts, sales, valued added, or capital expenditures.

Our paper contributes to the growing literature on the relationship between firms' financial and labor market decisions and provides new estimates of the ex ante wage costs associated with financial leverage based on a large sample of public U.S. firms. The most closely related paper to ours is Chemmanur, Cheng, and Zhang (2013). These authors study the relationship between leverage and employee compensation and find that workers are paid higher wages when leverage ratios are higher. Their measure of employee compensation is

²Wages of continuing employees have been documented to be relatively sticky, e.g. Barattieri, Basu and Gottschalk (2004).

based on Compustat data on labor and related expenses, and is an aggregate measure of employee pay. This variable is missing for approximately 90% of firms and cannot account for the changing composition of workers over time. The approach employed in our paper allows us to more precisely measure the effects of changes in firm leverage on employee wages, holding firm and employee characteristics constant and to more effectively overcome some of the empirical challenges facing the identification of the wage costs of firm debt. Other related papers are Graham, Kim, Li, and Qiu (2016), Agrawal and Matsa (2013), and Kim (2015). These papers all study the rank-and-file employees as we do. Other papers, such as Peters and Wagner (2014), examine the relationship between risk and CEO compensation.

Graham, Kim, Li, and Qiu (2016) study the long term effects on employee earnings following bankruptcy and uses the ex post wage loss to calculate an ex ante premium required to offset the realized losses. Agrawal and Matsa (2013) study the effects of changes in state unemployment benefits on firm leverage and use the observed relationship to calculate the labor costs of financial distress.³ Kim (2015) finds that the opening of new manufacturing plants leads to an increase in leverage for other manufacturing firms in the same county and interprets these findings as when employees are more costly, firms take on less debt. In contrast, our approach calculates the ex ante wage premium that employees do receive as compensation for the increased unemployment risk using a broad sample of public firms.

Our paper also relates to the labor economics literature on compensating differentials. For example, Topel (1984) uses variation in unemployment insurance coverage to estimate a compensating differential of 2.5% for a one point increase in the probability of unemployment.⁴ While papers in this literature typically exploit variation in aggregate risk, we incorporate firm-specific variation in unemployment risk into the analysis, which likely better captures the risk of employment of individual workers.

The remainder of the paper is organized as follows. Section I describes our theoretical

³Conversely, Matsa (2010) shows that leverage may be used as a bargaining tool in negotiations with organized labor and, in some cases, may be used to reduce the employment costs of the firm.

⁴Abowd and Ashenfelter (1981), Li (1986), Rosen (1986), and Moretti (2000) also estimate compensating differentials for bearing unemployment risk and find broadly similar effects.

motivation and empirical framework. Section II describes the data and variable construction. Section III describes the main results on the relation between changes in firm leverage and changes wages. Section IV discusses alternative measures of expected unemployment costs, while Section V examines alternative explanations of our results. Section VI discusses our estimates in relation to other estimates of the wage costs of firm debt. Section VII concludes.

1 Theoretical and Empirical Framework

Financial distress imposes significant costs on employees. Following periods of financial distress, firms significantly reduce employment (Hotchkiss (1995), Agrawal and Matsa (2013), Falato and Liang (2016)). This imposes costs on employees through two channels. First, search and matching frictions give rise to periods of unemployment (Mortensen and Pissarides (1994)), leading to lost wages and a deterioration in skills. Second, an unemployment spell can lead to lower wages in the long run due to the elimination of firm-specific capital (Becker (1962)) or due to a lower quality match between employee and employer (Jovanovic (1979)). Consistent with this theoretical evidence, Graham, Kim, Li, and Qiu (2016) find empirically that workers experience significantly lower wages for at least five years following a bankruptcy of their employer.

The ex post reduction in lifetime earnings suggests that employees of highly levered firms should be compensated for the increased distress risk. In other words, higher firm leverage should lead to higher employee compensation (Berk, Stanton, and Zechner (2010)).

Firm financial distress leads to a significant decline in employment, imposing large costs on its employees. These costs arise due to the fact that unemployment leads to lower lifetime earnings. The reduction in earnings is due both to long unemployment spells (Katz and Meyer (1990), Meyer (1990), and Krueger and Mueller (2010)) and lower wages in subsequent employment (Gibbons and Katz (1991), Farber (2005), Couch and Placzek (2010)).

Theoretical and empirical evidence suggests that firms compensate individuals for bear-

ing unemployment risk. For instance, in Abowd and Ashenfelter (1981), workers require a wage premium, also known as a compensating differential, to work for a sector with higher unemployment risk. Exploiting variation in unemployment risk across industries, they estimate individuals earn compensating differentials of up to 14%. Berk, Stanton, and Zechner (2010) provide theoretical support for a positive relationship between leverage and employee compensation which Chemmanur, Cheng, and Zhang (2013) find to be true empirically.

1.1 Labor Market Size as a Measure of Unemployment Costs

While theory predicts that increased firm leverage will lead to higher compensation for workers, unemployment risks are not constant across workers at a firm. For example, the individual’s labor market plays an important role in the magnitude of lost earnings, and individual workers in a firm may face different expected costs to unemployment based on their local labor markets (e.g., Moretti (2011)).

Our primary measure of expected unemployment costs for a given worker is the size of his local labor market, which we measure as the industry share of MSA employment relative to the industry share of national employment. Our choice of labor market size as a proxy for unemployment costs is informed by the literature on job search, such as Petrongolo and Pissarides (2006), who find evidence of economies of scale in labor markets. In particular, Petrongolo and Pissarides (2006) find that, individuals in larger labor markets have significantly higher reservation wages during unemployment and earn significantly higher wages following unemployment than those in smaller labor markets. In particular, unemployment is less harmful for individuals in larger labor markets as they earn higher wages upon returning to employment (Helsley and Strange (1990) and Petrongolo and Pissarides (2006)). Most related to our analysis, Graham, Kim, Li, and Qiu (2016) show that workers in larger labor market experience smaller wage losses following their employer’s bankruptcy than workers in smaller labor markets.

As a means of further justifying our main measure of unemployment costs at the lo-

cal labor market level, we present evidence that our measure of labor market size captures meaningful variation in unemployment costs. To do so, we identify single establishment firms in our main dataset that cease operations entirely. Due to the exit of the firm, workers at these firms experience a shock to their employment status that is plausibly unrelated to their individual-specific path of expected earnings. We then track the earnings of these workers for the five years following the firm’s exit and relate them to the size of the individual’s labor market. In particular, for each of the five years following the firm exit, we estimate:

$$\begin{aligned} Pay_{ikl,t+y} = & \alpha + \beta_1 LMS_{kl,t} + \beta_2 Y_{it} \\ & + \gamma_{lt} + \eta_{kt} + \sigma_{kl} + \nu_{ikl,t+y} \end{aligned} \quad (1)$$

where $Pay_{ikl,t+y}$ is the log annual pay for employee i in MSA k and industry l in year $t + y$ after the firm exit, $LMS_{kl,t}$ is the size of the labor market in MSA k and industry l , Y_{it} represents controls for employee i in year t including log average quarterly earnings in the year prior to the firm’s exit and controls for age, race, gender, and education. In addition, industry-year fixed effects γ_{lt} , MSA-year fixed effects η_{kt} , and MSA-industry fixed effects σ_{kl} are included. The results are presented in Table 1.

[Insert Table 1 here]

As the results in Table 1 show, labor market size is positively correlated with worker earnings following a firm exit. In particular, the positive and significant estimates in columns 1 through 4 imply that, for each of the first four years following a firm exit, workers in larger labor markets have higher earnings than workers in smaller labor markets. However, the effect dissipates over time such that, by year 5, the effect is no longer significant.

In terms of economic magnitudes, the estimate in column 1 implies that moving from a labor market equal to the 25th percentile in size to one at the 75th percentile equates to

approximately 1% higher earnings in the year immediately following the firm exit. The estimates in columns 2 through 4 suggest that a similar change in labor market size is associated with approximately a 0.3-0.4% increase in annual earnings in years 2 through 4 following the firm's exit. Accumulating these effects implies that total earnings are approximately 2.1% higher for workers in large labor markets than for workers in small labor markets. Thus, our measure of labor market size does appear to capture important variation in the expected costs of unemployment.

Showing that workers in smaller labor markets suffer larger earnings losses when their firms exit supports the argument that such a measure of labor market size captures meaningful variation in unemployment costs. However, if the probability of becoming unemployed is higher in larger labor markets relative to smaller labor markets, for example due to greater churn in such markets, this could serve to offset the smaller wage penalty to becoming unemployed in such labor markets, and in fact make unemployment costs higher in larger labor markets. To test whether this factor is empirically relevant, we identify whether workers exit from our main database (i.e., whether an individual has positive earnings in quarter $t+1$) as a proxy for leaving the labor market. We then test whether worker exit is associated with labor market size, controlling for worker characteristics and employer characteristics. In unreported results, we consistently find that the estimate on labor market share is statistically insignificant.

1.2 Empirical Framework

The compensation that workers receive in return for bearing unemployment risk should vary, even within a single firm. Our empirical framework examines large firms which operate in multiple local labor markets in which employees may face different costs of unemployment. Workers with relatively lower unemployment costs should receive a lower wage premium for unemployment risk than workers with relatively higher unemployment costs. In other words, when a firm increases its leverage, workers in large labor markets (those whom we argue face

lower unemployment costs) should experience lower pay growth than workers with small labor markets (those with higher unemployment costs).

To test this implication, we run panel regressions using worker-firm level data relating changes in worker pay to labor market size and its interaction with changes in firm leverage. Specifically, we estimate:

$$\begin{aligned}
\Delta Pay_{ijkl,t \rightarrow t+1} = & \alpha + \beta_1 \Delta Leverage_{j,t-1 \rightarrow t} LMS_{klt} \\
& + \beta_2 \Delta X_{j,t-1 \rightarrow t} LMS_{klt} \\
& + \beta_3 LMS_{klt} + \beta_4 Y_{it} \\
& + \gamma_{jt} + \eta_{kt} + \sigma_{km} + \nu_{ijkl,t \rightarrow t+1}
\end{aligned} \tag{2}$$

where $\Delta Pay_{ijkl,t \rightarrow t+1}$ is the growth in pay for employee i at firm j in MSA k and industry l from year t to $t + 1$, $\Delta Leverage_{j,t-1 \rightarrow t}$ is the change in book leverage for firm j from year $t - 1$ to t , LMS_{klt} is the size of the labor market in MSA k and industry l , $\Delta X_{j,t-1 \rightarrow t}$ represents a vector of controls for firm j from year $t - 1$ to t , and Y_{it} represents controls for employee i in year $t - 1$. In addition, firm-year fixed effects γ_{jt} , MSA-year fixed effects η_{kt} , and MSA-industry fixed effects σ_{km} are included.⁵ Therefore, estimates of β_1 measure the differential effect on wages that changes in firm leverage have on workers at the same firm residing in labor markets of different size. Note that we do not control for changes in firm characteristics in addition to their interactions with labor market size since we include firm-year fixed effects in our specification.

⁵We include worker fixed effects in some specifications but doing so is computationally intensive as there are approximately 14 million workers in our sample. Therefore, for many tests, we omit worker fixed effects.

2 Data Sources and Variable Construction

2.1 Data Sources

We construct a unique worker-firm-level dataset that combines data on individual workers with data on the firms for which they work. Worker-level data are from the U.S. Census Bureau’s Longitudinal Employer-Household Dynamics (LEHD) program. The LEHD data cover 25 states⁶ and provides detailed data on worker earnings and other characteristics. The Employment History File (EHF) provides data on quarterly earnings for each worker-firm pair. The Individual Characteristics File (ICF) provides data on worker age, place of birth, gender, education, and race.

We match the worker data to firm data from other Census datasets as well as Compustat and CRSP. We use the Census Bureau’s Longitudinal Business Database (LBD) to construct measures of employment and the number of establishments at the level of the firm and the firm-MSA. We also use the Census Bureau’s Census of Manufactures (CMF) and Annual Survey of Manufactures (ASM) to calculate measures of the value of shipments and value added at the level of the firm and the firm-MSA. The Census data are matched with Compustat and CRSP using the Compustat-SSEL bridge.⁷

Firms are classified to three digit SIC industries using industry codes from Compustat. In cases where the industry code is missing in Compustat, we use the industry code from CRSP. We exclude financial firms (SIC codes 6000-6999), utilities (SIC codes 4900-4999), and public administration firms (SIC codes 9000-9999) and restrict the sample to workers between the ages of 25 and 64. This yields a sample of 51,293,300 worker-level observations and 27,500 firm-year observations, covering approximately 14,000,000 workers at 4,200 firms

⁶The states in our sample are Arkansas, Georgia, Hawaii, Idaho, Illinois, Indiana, Iowa, Louisiana, Maine, Maryland, Montana, Nevada, New Jersey, New Mexico, North Carolina, Oklahoma, Oregon, Rhode Island, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, and Wisconsin. There is considerable variation across states in terms of the time period covered with some states having coverage from 1991 to 2008 with data for other states not beginning until 2000. The majority of states begin coverage on or before 1995.

⁷The current version of the Compustat-SSEL bridge is only available through 2005. We extend the bridge through 2008 using employer name and EIN following the procedure described in McCue (2003).

between the years 1991 and 2008.^{8,9}

2.2 Variable Construction and Summary Statistics

Our main dependent variable is the change in log average quarterly earnings at the firm. We calculate book leverage as debt in current liabilities plus long-term debt relative to assets.¹⁰ We follow Leary and Roberts (2014) to construct firm-level controls for profitability, size, market-to-book ratio, and asset tangibility. Marginal tax rates are from John Graham’s website.¹¹ Finally, our measure of labor market size is based on data from the LBD. This measure is calculated as the industry share of employment in an MSA relative to the industry share of employment for the nation, where industry is defined using three-digit SIC codes. For more detail on variable construction, see Appendix Table A1.

Table 2 provides summary statistics of key variables for our sample.¹² Panel A presents statistics for worker data. Average pay growth is high at 8.7% per year.¹³ Median pay growth, in contrast, is 1.4% per year. Average quarterly earnings are approximately \$11,000 with a median of approximately \$9,000.

Finally, the average labor market size is approximately 3.8, suggesting a high degree of industry agglomeration; the local industry share of employment is almost four times greater on average than the national industry share of employment. However, given that the median is only 1.08 and the standard deviation is approximately 10, there is significant variation

⁸Counts have been rounded to the nearest hundred following disclosure guidelines by the U.S. Census Bureau.

⁹Due to the limited geographical coverage of the LEHD, our final dataset includes 40% of the approximately 70,000 firm-year observations of the CRSP-Compustat universe with non-missing data for our key variables. See next section for a discussion of the representativeness of our final sample.

¹⁰In unreported tests, using market leverage and net leverage as alternative measures of firm leverage yields qualitatively similar results.

¹¹<https://faculty.fuqua.duke.edu/~jgraham/taxform.html>

¹²All variables are winsorized at the 1st and 99th percentiles.

¹³High average pay growth appears to be the result of high turnover rates at firms and the asymmetric nature of growth rates. Employees who join a firm in the middle of a period will have a very high rate pay growth for their second period of employment that is theoretically unbounded. Employees who leave a firm in the middle of a period will have low rate of pay growth that is bounded at -1. As a result, turnover will increase average rates of pay growth. To reduce this effect, we calculate average pay growth as the average quarterly pay in year $t + 1$ relative to t rather than using annual pay.

across workers in the size of their labor market.

[Insert Table 2 here]

Panel B presents statistics for data consolidated to firm-year observations. Average (median) firm book leverage is approximately 23% (21%). Consistent with the literature on the stability of firm leverage,¹⁴ the average (median) change in leverage is only 0.3% (-0.1%). However, the standard deviation is approximately 8%, suggesting that a substantial set of firms do exhibit large changes in leverage.¹⁵

As discussed above, due to the geographical coverage of LEHD, we match approximately 40% of firm-year observations from the intersection of CRSP and Compustat data. Comparing the summary statistics of our final sample with those for the CRSP-Compustat data, we find that, while firms in our sample are larger and more profitable than in the broader sample, leverage ratios are similar across the two samples. In particular, the mean firm sales in our sample is \$2.27 billion and the mean profitability is 12.6%, the mean firm sales in the full sample is \$1.22 billion and mean profitability is 4.4%. However, mean book leverage is very similar, at 23.1 for our sample and 22.2 for the full sample. Similarly, differences in mean market-to-book ratio (1.49 versus 1.75) and asset tangibility (0.291 versus 0.269) are small across the two samples.

3 Main Estimates of the Relation between Firm Leverage and Employee Wages

In this section, we examine the effect that firm leverage has on employee wages. Before we present the estimates of equation 2, which was laid out in Section 1.2, we first analyze the

¹⁴See, for example, Lemmon, Roberts and Zender (2008) and Graham and Leary (2011)

¹⁵This is consistent with the literature on adjustment costs such as in Leary and Roberts (2005).

correlation between leverage and wages. To do so, we estimate the regression

$$Pay_{ijklt} = \alpha + \beta_1 Leverage_{j,t-1} + \beta_2 X_{i,t-1} + \beta_3 Y_{j,t-1} + \gamma_j + \eta_k + \sigma_t + \eta_{it} \quad (3)$$

where Pay_{ijklt} is the natural log of pay for employee i at firm j in MSA k and industry l in year t , $Leverage_{j,t-1}$ is the book leverage for firm j in year $t - 1$ to t , $X_{j,t-1}$ represents a vector of controls for firm j in year $t - 1$, and $Y_{i,t-1}$ represents controls for employee i in year $t - 1$. In addition, firm fixed effects γ_j , MSA fixed effects η_k , and year fixed effects σ_t are included in certain specifications. The results are presented in Table 3.

[Insert Table 3 here]

We find no evidence that higher leverage is associated with higher employee pay. The estimated effect of leverage is negative in four of the six specifications and even negative and marginally significant in one specification. The negative estimates in columns 1 and 2 are in contrast to the positive and significant estimates from similar specifications in Table 6 of Chemmanur, Cheng, and Zhang (2013). However, there are key differences between the two sets of analysis, including differences in the set of firms included in each sample, differences in the unit of observation, and differences in control variables, that may account for the difference in the direction and magnitude of our estimates. Graham, Kim, Li, and Qiu (2016) estimate the relationship between wages and book leverage in their LEHD-based sample and also find an insignificant estimate on book leverage across their full sample of firms.

However, as discussed above, this analysis fails to account for potential selection bias, where we may not observe firms increasing leverage if doing so would lead to large increases in employee wages, and omitted variable bias, where unobservable factors such as productivity shocks affect both firm leverage and employee compensation. In other words, the estimates

in Table 3 may be downwardly biased. For instance, if firms tend to raise equity to invest in labor-augmenting technology, which increases labor productivity and therefore wages, we would expect to find a negative correlation between leverage and wages. To account for these sources of bias, we then estimate equation 2, which estimates changes in wages within firms on the interaction of changes in firm leverage and labor market size, and present the results in Table 4.

[Insert Table 4 here]

In contrast to the previous results, we find that leverage has an important effect on employee wages. In column 1, we find that the estimate of the interaction between the change in firm leverage and labor market size is negative and highly significant. In other words, the pay of employees in relatively small labor markets, in which workers have higher expected unemployment costs, increases in response to increased firm leverage, relative to employees at the same firm in larger labor markets.

In column 2, we include interactions between labor market size and several firm level controls – the change in EBITDA relative to assets, the change in market to book ratio, the change in log sales, the change in asset tangibility, and the change in the firm’s marginal tax rate. The coefficient on the interaction term remains negative and significant and is largely unchanged in magnitude. Next, in column 3, we include worker fixed effects to control for worker-level unobservable characteristics. While slightly smaller in magnitude, the coefficient on the interaction term remains negative and significant.

In column 4, rather than use a continuous measure for the firm controls, we use indicator variables for each quartile across the distribution of changes. We find that wages only respond to large increases in firm leverage; only the interaction between labor market size and the indicator variable for the top quartile of the change in firm leverage is negative and significant. This result is reasonable for several reasons. In particular, large increases in

firm leverage likely have the largest effect on unemployment risk. Moreover, employees are more likely to be aware of large increases in firm leverage than small changes in leverage as these changes are more likely to result in tangible changes at the firm and are more likely to attract media attention. As a result, it is these changes in firm leverage for which employees would plausibly demand compensation for increased risk.

In column 5, we interact labor market size with the log change in total firm debt, rather than the change in leverage. One potential concern is whether firm leverage is changing due to changes in the denominator of the leverage ratio, firm assets, rather than the numerator, firm debt. However, the estimates in column 5 show that the effect is due to changes in debt levels. The interaction of labor market size and the change in firm debt also enters negatively and significantly.

To understand the economic magnitudes of the estimate, consider two employees at a firm. The labor market of Employee A is in the 25th percentile of size while the labor market of Employee B is at the 75th percentile of size. If the firm increases its leverage by 10 percentage points, the estimates in column 2 imply that Employee A earn approximately 0.2% more than Employee B due to the change in leverage.

3.1 Baseline Estimates of the Wage Costs of Firm Leverage

We next use these cross-sectional estimates to calculate the effect of firm leverage on employee compensation. To do so, we need to identify a control group, a group of workers for whom increased leverage has no effect on their compensation. We choose as our control group the set of workers in the top decile of labor market size. Because their labor market is so large, their unemployment risk is likely to be very low and, as a result, they likely receive little to no additional compensation due to higher firm leverage. To the extent to which workers in the top decile are compensated as a result of increased leverage, the estimates below will understate the true wage costs of leverage.

We then split all workers into subsamples based on the decile of labor market size and

then calculate the average labor market size for each of the deciles. Under the assumption that workers in the top decile are a valid control group and thus require no wage premium for increased firm, we can then calculate the effect of firm leverage on compensation for workers in each decile of the labor market size distribution. To do so, we calculate the difference between the average labor market size for that decile and the average for the top decile and then multiply that by the estimate on the interaction between labor market size and the change in firm leverage. This yields an estimate for the effect of a one-unit change of firm leverage on a given worker's compensation.

To be more concrete, consider a worker in the fifth decile of labor market size. To calculate the effect of firm leverage on that worker's compensation, we calculate the difference between the average labor market size for workers in that decile and the average size for workers in the top decile, which is approximately 23.8. We then multiply 23.8 by the estimate on the interaction between labor market size and the change in firm leverage. Using the estimate from column 2 of Table 4 of -0.008, this yields approximately 0.2. Since the dependent variable is the natural log of the average quarterly earnings in year $t + 1$ minus the natural log of the average quarterly earnings in year t , we then raise e to the power of 0.2 and subtract 1 to calculate the effect of a one unit change on the level of worker's compensation. We then multiply that effect by 0.1 to estimate that a 10 percentage point increase in firm leverages increases pay by approximately 1.9%.

With this framework, we can estimate the effect of leverage on the compensation for every worker in the firm as a function of their labor market size.¹⁶ We then sum the worker-level effect across all workers at the firm to calculate the total change in pay at the firm.

Assuming again that the top decile is a legitimate control group, the estimate in column 2 of Table 4 implies that, for a 10 percentage point increase in the leverage of the average firm in CRSP and Compustat that is matched to the LBD, total firm payroll increases by

¹⁶Note that we are able to use the LBD for this calculation because labor market size is defined using only the industry and MSA of the worker. As a result, this calculation incorporates U.S. employees at the firm located in any MSA in the country.

approximately 0.5%.¹⁷ Calculated relative to the market value of firm assets, as in Almeida and Philippon (2007), this estimate implies that payroll increases by approximately 17 basis points of firm market value. Almeida and Philippon (2007) calculate that the difference between the tax benefits and costs of financial distress are at most 65 basis points of firm value for BBB-rated firms. Our estimates therefore imply that the added labor costs can account for a meaningful fraction of this difference.

3.2 Estimates on Subsamples of Workers

While we document a significant wage effect across all workers on average, certain workers may be more aware of the unemployment risks associated with an increase in firm leverage or have greater bargaining power and may therefore negotiate greater wage increases relative to other employees who may be less informed or have lower relative bargaining power.

3.2.1 Estimates for New Employees

One set of workers that may be more likely to be compensated for higher leverage is new employees; Barattieri, Basu and Gottschalk (2014) find that workers that switch jobs are much more likely to have a change in wage than workers that remain at the same firm.¹⁸ Therefore, we re-estimate equation 2 where the dependent variable is the log average quarterly wage in year $t + 1$ for all workers who joined the firm at any point in year t . The results are presented in Table 5.

[Insert Table 5 here]

As expected, the effects on new employee wages are stronger than the effects on existing employees. In columns 1 and 2, the estimate on the interaction term is positive and statis-

¹⁷The effect of leverage on the average worker and the average firm differ because of the distribution of workers across firms and our non-linear estimation procedure.

¹⁸See Topel and Ward (1992) for additional evidence on the relationship between the role of job changes on wage growth.

tically significant. Moreover, the estimate in column 2 implies that a new employee whose labor market size is equal to the 25th percentile will earn approximately 0.5% more than a new employee at the 75th percentile of labor market size due to a 10 percentage point increase in leverage.

Exploiting the cross-sectional results to estimate the effect of leverage on pay as described above, the estimate implies that the 10 percentage point increase in leverage increases pay for the average new worker by 8.5%. Similar to the results in Table 4, we find in column 3 that the effect on pay arises due to large increases in leverage. Finally, in column 4, we use the change in log debt in place of the change in leverage and again find that interaction term enters negatively and significantly.

3.2.2 Other Measures of Employee Bargaining Power

For employees to be compensated for the higher risk of unemployment associated with higher firm leverage, they need to understand that higher leverage, all else equal, does increase the probability of unemployment and they need to possess sufficient bargaining power to be compensated for the higher risk of unemployment. Next, we show that the effects are stronger for employees who are more likely to understand the relationship between firm leverage and unemployment risk and for employees with relatively more bargaining power.¹⁹

[Insert Table 6 here]

First, in Table 6, to show that employees who likely have a greater understanding of the relationship between firm leverage and the probability of unemployment, we employ two sample splits. In columns 1 through 4, we divide the sample in quartiles on the basis of

¹⁹In addition to influencing the effect of leverage on employee wages, bargaining power also may affect capital structure decisions. Matsa (2010) finds evidence that stronger bargaining power, as measured by the degree of unionization, leads to lower firm leverage. In our analysis, we treat bargaining power as exogenous to the capital structure decision. Given that we analyze within-firm variation across multiple labor markets, this seems to be a reasonable assumption.

income within the firm. Income is a proxy for human capital and so more highly paid individuals are more likely to understand the downsides of higher firm leverage. In addition, more highly paid workers are likely more involved in the decision making of the firm and thus are more aware of the tradeoffs of higher leverage.

We do, in fact, find some evidence that the effect is increasing in the level of employee compensation. In columns 1 and 2, where the sample is employees in the lowest two quartiles of compensation at the firm, the coefficient on the interaction of the change in firm leverage and labor market size is insignificant. In other words, we find no evidence that the lowest paid employees at the firm are compensated as a result of higher firm leverage. Looking at the results in columns 3 and 4, for employees in the third and fourth quartiles of compensation of the firm, we find that the coefficient is negative and significant for both samples. Moreover, the magnitude of the coefficient is largest for the top quartile of earners, suggesting that the more highly paid a worker is, the higher the premium he receives in response to higher firm leverage.

Exploiting the cross-sectional variation to estimate the effect of firm leverage on wages, as detailed above, the estimates imply relatively little difference at different levels of pay. In particular, for the highest quartile, the estimates imply that a 10 percentage point increase in firm leverage increases compensation for a worker in the median decile of labor market size by approximately 2.1%, only slightly higher than the effect for the total population.

In columns 5 and 6, we divide the sample on the basis of exposure to the effects of bankruptcy on employment. To do so, we identify bankruptcies of public firms from the UCLA-LoPucki Bankruptcy Research Database. After matching these firms to Census data, we identify MSA-industry markets where a public firm declared bankruptcy in the prior 5 years and classify individuals in those markets as being exposed to the effects of bankruptcy. We find evidence that, in fact, the compensation of individuals with exposure to bankrupt firms is more sensitive to changes in firm leverage. In particular, the estimate on the interaction of the change in book leverage and labor market size is negative and large in magnitude,

albeit only marginally significant, for individuals with a public firm bankruptcy within their labor market in the prior 5 years. For individuals without a recent public firm bankruptcy, the estimate on the interaction term is positive, small in magnitude, and statistically insignificant. In terms of how leverage affects pay differentially for these two groups, the estimates in columns 5 and 6 imply workers in those labor markets earn approximately 7.1% more in response to a 10 percentage point increase in firm leverage.

Next, to show that the relationship between firm leverage and employee compensation is stronger when employees have greater bargaining power, we split the sample in two ways. In columns 1 and 2 of Table 7, we separate the sample on the basis of the local unemployment rate; in column 1, the sample is restricted to markets with an unemployment rate of 5 percent or less and, in column 2, the sample is restricted to markets with an unemployment rate of more than 5 percent. In times of low unemployment, employees have more attractive outside options and therefore have relatively more bargaining power than in times of high unemployment (Christofides and Oswald (1992)). As a result, workers should be more likely to receive compensation for higher firm leverage.

[Insert Table 7 here]

This is precisely what we find in columns 1 and 2. In labor markets with more slack, employees do not receive additional compensation for higher firm leverage, as the interaction term in column 1 is negative but insignificant. In column 2, the interaction term is negative and significant; in other words, in tighter labor markets, employees are compensated for increases in firm leverage. It is important to note that the unemployment rate is not a clean measure of bargaining power, as it certainly affects an individual's unemployment risk as well – when the unemployment rate is low, the risk of extended unemployment spells is lower. These results simply document that, while compensating wages are lower in larger labor markets than in smaller labor markets, the differential is greater when local unemployment

rates are lower.

In columns 3 and 4, we split the sample on the basis of the competitiveness of the local labor market. For each MSA-industry market, we calculate the Herfindahl-Hirschman index (HHI) across firms using employment shares. The sample in column 3 is restricted to less competitive labor markets, defined as markets with an HHI of 1500 or greater, and the sample in column 4 is restricted to more competitive markets, defined as markets with an HHI of less than 1500. As with the splits based on local unemployment rates, we find that the relationship is stronger for markets where workers likely have relatively more bargaining power. While the estimate in column 3 is positive and insignificant, the estimate of the interaction of the change in firm leverage and labor market size in column 4 is larger in magnitude than the full sample results.

Translating these estimates into an estimate of the impact of leverage on pay, the estimates imply that a 10 percentage point increase in leverage increases worker compensation by 4.2% for those in MSAs with an unemployment rate of less than 5% while it increases by 0.6% for workers in MSAs with an unemployment rate of 5% or higher. Employment concentration across firms in the market also dramatically influences the effect; in markets with low employment concentration, with an HHI of less than 1500, compensation increases by 2.5% for workers in the median size decile. In other words, workers in more competitive labor markets are compensated significantly for increased firm leverage while workers in less competitive markets are not.

4 Alternative Measures of Unemployment Risk

We have documented an important relationship between employee wages, firm leverage, and labor market size within firms. We argued previously that our choice of labor market size is a good proxy for employees' expected unemployment costs and one that allows us to examine a large sample of firms and workers while still holding fixed a number of important

geographical, time, firm, and employee characteristics constant. In this section, we explore the robustness of our results to alternative measures of unemployment risk.

4.1 Subsamples of Firms by Employment Growth

If the relationship between changes in firm leverage and employee wages by labor market size arises as compensation for increased unemployment risk born by employees, we would expect that the effects are strongest for workers with an elevated probability of unemployment. Therefore, in Table 8 we re-estimate equation 2 for workers at firms that are expanding employment and firms that are not separately. Specifically, in column 1, the sample is restricted to employees at firms whose total employment in year $t + 1$ was greater than year t employment and, in column 2, the sample is employees at firms whose year $t + 1$ employment was no greater than year t . Similarly, in column 3, the sample is restricted to employees at firms whose MSA employment in year $t + 1$ was greater than year t employment and, in column 4, the sample is employees at firms whose year $t + 1$ MSA-specific employment was no greater than year t .

[Insert Table 8 here]

Regardless of how expanding firms are identified, we find that the relationship between firm leverage, labor market size, and compensation is only significant at firms that are not expanding. In columns 1 and 3, the coefficient on the interaction term is positive and insignificant. For the samples of workers at firms that are not expanding in columns 2 and 4, the estimate is negative and significant. We then replicate the process described above to translate these estimates into an estimate of the effect of leverage on employee pay. In terms of magnitudes, the estimates imply that leverage increases compensation by approximately 4.5% for workers in the median size decile at firms with declining total employment and by approximately 5.1% for workers at firms whose employment in the MSA is declining. Thus,

it does appear that our results are driven by workers with an elevated risk of unemployment.

4.2 Alternative Measures of Labor Market Size

In the results discussed above, we have used a specific measure of labor market size as a proxy for unemployment risk. We now discuss alternative measures of labor market size as well as other possible proxies for unemployment risk.

[Insert Table 9 here]

In Table 9, we replicate our main results from Tables 4 and 5 using three alternative measures of labor market size. First, in columns 1 and 4, we measure the size of an individual's labor market as the industry share of employment in an MSA. In columns 2 and 5, we use the industry share of establishments in an MSA relative to the national average. In columns 3 and 6, we use the industry share of young firms — defined as firms that are ten years old or younger — in an MSA.²⁰ With all three measures, we find results that are qualitatively similar to our main results. For continuing workers, the same sample as in Table 4, we find that the estimate on the interaction of labor market size and the indicator for a large increase in firm leverage is negative and significant. Similarly, for new workers, the sample from Table 5, the estimate is consistently negative and significant. In other words, across these three measure of labor market size, workers in smaller labor markets earn more than workers at the same firm in larger labor markets due to an increase in firm leverage.

²⁰The focus on young firms, rather than all firms, is motivated by Haltiwanger, Jarmin, and Miranda (2013), who find that younger firms experience significantly higher employment growth than older firms, conditional on survival. This finding suggests that younger firms are likely to be the relevant outside option.

4.3 Measures Based on Unemployment Insurance

We have also explored the use of various measures of UI generosity to proxy for unemployment risk. These proxies include both aggregate measures such as the state-specific weekly maximum benefit and individual-specific measures of benefits that we can estimate using LEHD data. Generally, we do not find a robust relationship between leverage and employee wages using these UI measures as proxies for unemployment risk for the full sample of workers.

However, for several subsamples, we have found evidence that, when a firm increases its leverage, workers at the firm with lower unemployment benefits experience larger wage increases. In particular, in unreported results, we find that, among employees in the top quartile of earnings at the firm, those with lower unemployment benefits do experience significantly higher wage growth. This relationship is not significant for employees in the bottom three quartiles. As argued above, employees need to understand the effect of leverage on their employment risk and to have sufficient bargaining power in order to successfully bargain for higher wages and this is most likely the case for higher earners.

In addition, we find that the relationship between leverage, employee wages, and UI benefits is significant for employees at firms with higher probability of financial distress. Among these firms, we do find that, when a firm increases its leverage, employees with lower UI benefits experience significantly higher wage growth than workers with higher UI benefits at the firm. For firms with a low probability of financial distress, the relationship is not significant.

5 Exploring Alternative Explanations for the Observed Relationship between Changes in Firm Leverage and Employee Wages

While we find evidence that the associations between firm leverage, labor market size, and employee compensation arise due to firms compensating employees for bearing unemployment risk, there are alternative explanations for our results. In this section, we explore several of these explanations and find evidence that is inconsistent with these explanations, further lending support to our interpretation that higher wages are compensation for increased unemployment risk associated with increases in leverage.

The first alternative explanation for our results is reverse causality; that is, firms are raising new and increasing leverage in order to pay higher wages. To rule out this explanation, we explore the timing of the relationship in Table 10. In columns 1-4, the dependent variable is log pay growth from year $t - 2$ to $t - 1$, log pay growth from year $t - 1$ to t , log pay growth from year $t + 1$ to $t + 2$, and log pay growth from year $t + 2$ to $t + 3$, respectively.

[Insert Table 10 here]

For all four years, we find no evidence that the compensation of employees in smaller labor markets is not more sensitive to changes in leverage than that of employees in larger labor markets at the same firm. In all specifications, we find an insignificant relationship between wage growth and the interaction of labor market size and changes in firm leverage. Thus, given that the relationship between firm leverage, labor market size, and employee compensation is observed in only the year immediately following the increase in firm leverage, it is unlikely that reverse causality accounts for our findings.

An alternative explanation for the effect on wages is that it is due to higher labor productivity rather than compensation for unemployment risk. For instance, suppose that there is

a positive productivity shock in a given MSA-industry. Firms respond by increasing employment, thereby increasing the size of the labor market. At the same time, public firms raise equity to increase more heavily in their establishments in that market. These investments increase labor productivity and therefore wages rise. While this provides an explanation for our previous results, we do not find evidence of a contemporaneous productivity shock.

First, we test directly for an effect on labor productivity. We use data on establishment-level output from the Census of Manufactures and Annual Survey of Manufactures to calculate measures of average labor productivity at the firm-MSA level. We then re-estimate equation 2 with measures of labor productivity as the dependent variable. The results are presented in Table 11.

[Insert Table 11 here]

In column 1 and 2, we study the effect on the growth in average output per worker. We find that the estimate on the interaction of the change in firm leverage and labor market size is insignificant and small in magnitude. Similarly, in the estimates of the growth in average value added per worker in columns 3 and 4, the interaction term enters negatively but insignificantly. Thus, there is no evidence of a differential effect on labor productivity.²¹

[Insert Table 12 here]

Second, we test whether firm behavior is consistent with localized productivity shocks. In particular, if a particular set of a firm’s establishments become more productive, we would expect those establishments to grow faster than the firm’s other establishments. To test for difference in growth rates within a firm, we calculate firm-state measures of growth in

²¹In specifications for this subsample with wage growth as the dependent variable, the estimate on the interaction term is negative and larger in magnitude than the full sample estimate but is statistically insignificant. In alternative tests using state-level measures, we find the interaction term is negative and significant for the wage regressions and positive and insignificant for the labor productivity measures.

employment and number of establishments from the LBD and growth in output per worker, value added per worker, and capital expenditures for manufacturing firms from the CMF and ASM and then re-estimate equation 2. The results are presented in Table 12. In all five tests, we find an insignificant effect of the interaction of the change in leverage and labor market size. Thus, there is no evidence that firms are reallocating resources towards its operations in smaller labor markets following an increase in leverage, which is inconsistent with those markets receiving a positive productivity shock.

6 Comparison with Prior Estimates of the Wage Costs of Debt

In this section, we discuss our estimates in relation to other estimates of the effects of changes of firm leverage on employee compensation. As discussed above, our estimates from Table 4 imply that a 10 percentage point in book leverage increases compensation for the median worker by approximately 1.9%. We also find that new employees earn approximately 8.5% more as a result of the increased leverage.

Despite being derived in a different manner to prior studies, this estimate is similar to other estimates of wage premium elasticities. For instance, Chemmanur, Cheng, and Zhang (2013) use Compustat data to examine the relationship between firm leverage and average employee pay. Using marginal corporate tax rates as an instrument for leverage, they find that an increase in market leverage of 10 percentage points, average employee pay increases by approximately 2.4% for the average firm.

Graham, Kim, Li, and Qiu (2016) take a different approach to estimating the required premium by calculating the realized wage losses workers experience as a result of a corporate bankruptcy. They then estimate the implied ex ante wage premium that would be required to offset these ex post losses for employees at firms with a given credit rating, using the risk neutral probability of default following Almeida and Phillippon (2007). Using this proce-

dure, they estimate that, for workers at the average firm, compensation needs to increase by 1.0% for a 10 percentage point increase in book leverage and 2.3% for a similar increase in market leverage to compensate for expected wage loss.

We also provide an estimate of the effect of leverage on aggregate labor costs at the firm. In our framework, we find increased leverage increases compensation for continuing workers by approximately 17 basis points for the average firm. Our estimates are likely a lower bound for the wage costs of leverage, given that we assume that the workers in the top decile of labor market size are not compensated for increased leverage. To the extent that those workers are compensated, that would increase the effect for workers across the distribution of labor market size.

Agrawal and Matsa (2013) use variation in the generosity of state unemployment insurance (UI) benefits to back out the cost of distress due to unemployment. In particular, they first estimate the effect that changes on UI benefits has on firm capital structures and find that increased UI benefits leads to increased leverage for firms headquartered in the state. Because they do not observe employee wages, to calculate the ex ante labor costs of leverage, they need to make several assumptions about the probability of firm default, the probability of being laid off conditional on a bond default, and the wage premium for the increase in unemployment risk. For these values, they use estimated default probabilities by credit rating from Altman (2007), the wage premium per unit of unemployment risk from Topel (1984), and the probability of being laid off conditional on a bond default, which they estimate using Compustat data. Combining these data, they are able to estimate the average value of the compensating wage premium, which they calculate to range from 1 basis point of firm value for a AAA-rated firm to 159 basis points of firm value for a B-rated firm. Our estimate of 17 basis points of firm value for the average firm falls between the premium for a A-rated firm and a BBB-rated firm, consistent with Compustat data on the distribution of credit ratings.

Graham, Kim, Li, and Qiu (2016) also back out the effects of the required wage premium at the firm level using their worker-level estimates. Using their preferred specification, they

find required wage premia ranging from 6 basis points of firm value for a AAA-rated firm to 419 basis points of firm value for a B-rated firm. These estimates are noticeably higher than our estimate for the average firm. However, our estimates are likely more representative of the typical ex ante wage costs associated with debt compared to Graham, Kim, Li and Qiu (2016) since our approach does not rely on wage losses of employees at bankrupt firms to infer ex ante wage costs. Our estimates suggest that bargaining power of employees is an important determinant of their ex ante wage compensation for increased leverage, suggesting that the estimates in Graham, Kim, Li, and Qiu (2016) provide an upper bound estimate on the true wage costs of firm leverage.

7 Conclusion

We find evidence that higher firm leverage increases employee wages. Exploiting within-firm variation in labor market size as a proxy for expected unemployment risk, we find that employees in smaller labor markets experience higher wage growth than other employees in response to increased firm leverage. This effect is stronger for new employees and is robust to alternative specifications of labor market size.

Our results suggest that the higher wages are compensation for unemployment risk and not driven by reverse causality or an unobserved productivity shock. At the firm level, the added labor costs due to higher leverage are significant and represent a significant fraction of the difference between the tax benefits of debt and costs of financial distress. Thus, labor costs appear to be a significant factor in determining optimal debt levels. However, our estimates are lower than those in prior studies which examine ex post wage losses following financial distress.

Our findings add to previous work on the effect of firm debt on employee wages. In particular, our analysis has several key advantages relative to previous studies. We exploit worker-level data for a large sample of firms, not only those have experienced bankruptcy

or other types of financial distress. Moreover, we use this worker-level data to estimate the realized wage premia employees earn for bearing the risks associated with higher firm leverage and to understand how the premia vary across workers. These features of our analysis allow us to provide more general estimates of the wage costs of debt across firms.

Higher wage costs are just one potential effect of debt on firm employees. Higher leverage may also have an effect on employee turnover or the ability of firms to hire employees. Indeed, Brown and Matsa (2016) show that increased firm financial distress leads to fewer employment applications, and effect that may also be present for firms increasing their leverage ratios. While we find that employees are compensated for higher leverage on average, variation in bargaining power, firm-specific capital, and risk aversion likely means that a substantial fraction of employees are not adequately compensated for bearing this risk. As a result, employees would likely benefit from moving to a new firm in response to an increase in firm leverage which raises the likelihood of financial distress. Higher debt levels may also reduce the incentive for development of firm-specific capital as the higher probability of distress reduces its long-term benefits. Therefore, labor considerations beyond total wage compensation likely factor into the costs of debt and may play a larger role in determining optimal debt levels than wage effects suggest. Such questions pose fruitful areas of future research.

Appendix

Table A1: Variable Definitions

This table presents definitions for the key variables used in the analysis. Workers, firms, establishments, MSA, industries, years and quarters are indexed by i , j , e , k , l , t , and q , respectively. Data sources are the Census Bureau's Longitudinal Employer-Household Database (LEHD), the Census Bureau's Longitudinal Business Database (LBD), Compustat, the Census Bureau's Census of Manufactures (CMF), and the Census Bureau's Annual Survey of Manufactures (ASM).

Variable Name	Description	Source	Definition
Pay	Sum of quarterly earnings (in 2007 dollars) relative to number of quarters with positive earnings	LEHD	$\sum_{q=1}^4 Earn_{ijtq} / \sum_{q=1}^4 \mathbb{1}_{Earn_{ijtq} > 0}$
ΔPay	Change in log Pay	LEHD	$Ln(Pay_{t+1}) - Ln(Pay_t)$
LMS	Industry share of MSA employment relative to industry share of national employment	LBD	$\frac{(Emp_{klt}/Emp_{kt})}{(Empl_t/Empt)}$
Total Debt	Book value of firm debt	Compustat	$dltt_{jt} + dlc_{jt}$
Δ Total Debt	Change in log $Debt$	Compustat	$Book\ Total\ Debt_t - Total\ Debt_{t-1}$
Leverage	Firm book leverage	Compustat	$\frac{dltt_{jt} + dlc_{jt}}{at_{jt}}$
Δ Leverage	Change in $Leverage$	Compustat	$Book\ Leverage_t - Book\ Leverage_{t-1}$
Market Value	Firm market value of assets	Compustat	$prcc_{f,jt} * cshpri_{jt} + dlc_{jt} + dltt_{jt} + pstkl_{jt} - txditc_{jt}$
Market / Book	Firm market-book ratio	Compustat	$\frac{Market\ Value}{at_{jt}}$
Δ Market / Book	Change in $Market / Book$	Compustat	$Market / Book_t - Market / Book_{t-1}$

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Variable Name	Description	Source	Definition
Sales	Firm sales	Compustat	$sale_{jt}$
Δ Sales	Change in log $Sales$	Compustat	$Ln(Sales_t) - Ln(Sales_{t-1})$
EBITDA / Assets	Firm return on assets	Compustat	$\frac{oibdp_{jt}}{at_{jt}}$
Δ EBITDA / Assets	Change in $EBITDA / Assets$	Compustat	$EBITDA / Assets_t - EBITDA / Assets_{t-1}$
Asset Tangibility	Firm asset tangibility	Compustat	$\frac{ppent_{jt}}{at_{jt}}$
Δ Asset Tangibility	Change in $Asset Tangibility$	Compustat	$Asset Tangibility_t -$
Marginal Tax Rate	Firm marginal tax rate	John Graham	$begmtrint_{jt}$
Δ Marginal Tax Rate	Change in $Marginal Tax Rate$	Compustat	$Marginal Tax Rate_t - Marginal Tax Rate_{t-1}$
MSA Emp	Firm-MSA employment	LBD	$\sum_e emp_{jkt}$
Δ MSA Emp	$MSA Emp$ growth rate	LBD	$\frac{MSA Emp_{t+1} - MSA Emp_t}{MSA Emp_t}$
MSA Estab	Firm-MSA establishment count	LBD	$\sum_e \mathbb{1}_{emp_{jkt} > 0}$
Δ MSA Estab	$MSA Estab$ growth rate	CMF, ASM	$\frac{MSA Estab_{t+1} - MSA Estab_t}{MSA Estab_t}$
MSA Sales	Firm-MSA sales	CMF, ASM	$\sum_e tvs_{jkt}$
Δ MSA Sales	$MSA Sales$ growth rate	CMF, ASM	$\frac{MSA Sales_{t+1} - MSA Sales_t}{MSA Sales_t}$
MSA Value Add	Firm-MSA value added	CMF, ASM	$\sum_e va_{jkt}$
Δ MSA Value Add	$MSA ValueAdd$ growth rate	CMF, ASM	$\frac{MSA ValueAdd_{t+1} - MSA ValueAdd_t}{MSA ValueAdd_t}$

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Variable Name	Description	Source	Definition
MSA CapEx	Firm-MSA capital expenditures	CMF, ASM	$\sum_e cape x_{jkt}$
Δ MSA CapEx	<i>MSA CapEx</i> growth rate	CMF, ASM	$\frac{MSA CapEx_{t+1} - MSA CapEx_t}{MSA CapEx_t}$
Labor Prod	Firm-MSA sales per employee	CMF, ASM	$\frac{MSA Sales}{MSA Emp}$
Δ Labor Prod	Change in log <i>Labor Prod</i>	CMF, ASM	$Ln(Labor Prod_{t+1}) - Ln(Labor Prod_t)$
Value Add per Emp	Firm-MSA value added per employee	CMF, ASM	$\frac{MSA Value Add}{MSA Emp}$
Δ Value Add per Emp	Change in log <i>Value Add per Emp</i>	CMF, ASM	$Ln(Value Add per Emp_{t+1}) - Ln(Value Add per Emp_t)$

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Table 1: Labor Market Size and Earnings: Evidence from Firm Exits

This table presents OLS regressions using log annual earnings as the dependent variable. The key independent variable is labor market size (LMS). Worker controls include log average quarterly pay in the year prior to firm exit and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate and are included in all specifications. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Standard errors are adjusted for clustering by industry and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
LMS	0.016*** (0.003)	0.005*** (0.002)	0.007*** (0.002)	0.006*** (0.002)	0.002 (0.002)
Year	$t + 1$	$t + 2$	$t + 3$	$t + 4$	$t + 5$
MSA-Year FE	yes	yes	yes	yes	yes
SIC3-Year FE	yes	yes	yes	yes	yes
MSA-SIC3 FE	yes	yes	yes	yes	yes
Obs	28,660,000	24,680,000	21,710,000	19,240,000	16,920,000
R-squared	0.28	0.25	0.21	0.19	0.17

Table 2: Summary Statistics

This table presents summary statistics for worker-level variables in Panel A and firm-level variables in Panel B. The sample consists of 51,293,300 worker-firm-year observations, covering approximately 14,000,000 unique workers and 4,200 unique firms, from 1991 through 2008. See Appendix Table A1 for variable definitions.

	N	Mean	Std. Dev.	Median
Panel A: Worker Level Variables				
Δ Pay	51,293,300	0.087	0.652	0.014
Pay	51,293,300	11,029.25	8,870.277	9,101.673
LMS	51,293,300	3.809	10.004	1.077
Panel B: Firm Level Variables				
Leverage	27,500	0.231	0.191	0.210
Δ Leverage	27,500	0.003	0.078	-0.001
Market / Book	27,500	1.485	1.137	1.114
Δ Market / Book	27,500	-0.045	0.636	-0.008
Sales	27,500	2,270.289	8,732.016	379.234
Δ Sales	27,500	0.099	0.214	0.081
EBITDA / Assets	27,500	0.126	0.091	0.129
Δ EBITDA / Assets	27,500	-0.005	0.058	0.000
Asset Tangibility	27,500	0.291	0.207	0.242
Δ Asset Tangibility	27,500	-0.002	0.043	-0.002
Marginal Tax Rate	27,500	0.276	0.093	0.322
Δ Marginal Tax Rate	27,500	-0.002	0.049	0.000

Table 3: Employee Pay and Leverage

This table presents OLS regressions using one year ahead worker log average quarterly pay as the dependent variable. The key independent variable is firm leverage (*Leverage*). Worker controls include indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. In columns 1 through 3, the dependent variable and the independent variables are in levels, and in columns 4 through 6, they are first differenced. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Leverage	0.234 (0.240)	0.120 (0.140)	-0.028 (0.038)	-0.018 (0.017)	-0.001 (0.021)	-0.027* (0.016)
Market / Book		0.069*** (0.024)	0.003 (0.007)		0.019*** (0.005)	0.011*** (0.002)
EBITDA / Assets		-0.821*** (0.278)	-0.035 (0.082)		-0.006 (0.042)	0.063** (0.032)
Log Sales		0.060*** (0.017)	0.008 (0.012)		0.041*** (0.012)	0.017** (0.008)
Asset Tangibility		-0.255* (0.143)	-0.153** (0.064)		-0.086** (0.040)	-0.066* (0.037)
Marginal Tax Rate		-0.362** (0.182)	-0.045 (0.060)		0.038 (0.069)	0.033 (0.075)
Obs	51,293,300	51,293,300	51,293,300	51,293,300	51,293,300	51,293,300
R-squared	0.00	0.36	0.57	0.00	0.02	0.05
Levels/Diff	Levels	Levels	Levels	Diff	Diff	Diff
Worker Controls	no	yes	yes	no	yes	yes
Year FE	no	no	yes	no	no	yes
MSA FE	no	no	yes	no	no	yes
Firm FE	no	no	yes	no	no	yes

Table 4: Employee Pay, Labor Market Size, and Leverage

This table presents OLS regressions using change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of labor market size (LMS) and the change in firm leverage ($\Delta Leverage$). Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in columns 2-8. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate and are included in all specifications. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
LMS * $\Delta Leverage$	-0.008** (0.004)	-0.008** (0.004)	-0.006* (0.004)		
LMS * (2nd Quartile $\Delta Leverage$)				-0.001 (0.001)	
LMS * (3rd Quartile $\Delta Leverage$)				-0.001 (0.001)	
LMS * (4th Quartile $\Delta Leverage$)				-0.001** (0.001)	
LMS * $\Delta TotalDebt$					-0.002** (0.001)
LMS	-0.001* (0.001)	-0.001* (0.001)	0.000 (0.000)	-0.001 (0.001)	-0.001*** (0.000)
Worker Controls					
Firm-Year FE	yes	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes	yes
Worker FE	no	no	yes	no	no
Obs	51,293,300	51,293,300	51,293,300	51,293,300	51,293,300
R-Squared	0.06	0.06	0.42	0.06	0.06

Table 5: Employee Pay, Labor Market Size, and Leverage — New Employees

This table presents OLS regressions using worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of labor market size (LMS) and the change in firm leverage ($\Delta Leverage$). The change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in column 1. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in columns 2 through 4. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year and the sample is restricted to new employees at the firm. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
LMS * $\Delta Leverage$	-0.093*** (0.028)	-0.077*** (0.024)		
LMS * (2nd Quartile $\Delta Leverage$)			-0.009 (0.009)	
LMS * (3rd Quartile $\Delta Leverage$)			-0.003 (0.007)	
LMS * (4th Quartile $\Delta Leverage$)			-0.008*** (0.004)	
LMS * $\Delta TotalDebt$				-0.008*** (0.004)
LMS	0.003 (0.002)	0.002 (0.003)	0.004 (0.003)	0.000 (0.003)
Worker Controls				
Firm-Year FE	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes
Obs	19,551,900	19,551,900	19,551,900	19,551,900
R-squared	0.79	0.80	0.85	0.80

Table 6: Estimates using Subsamples Based on Employee Background

This table presents OLS regressions using the change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of labor market size (LMS) and the change in firm leverage ($\Delta Leverage$). The change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in column 1. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in columns 2 and 3. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Column 1 restricts the sample to workers in the bottom quartile of earnings at the firm, column 2 restricts the sample to workers in the second quartile of earnings at the firm, column 3 restricts the sample to workers in the third quartile of earnings at the firm, column 4 restricts the sample to workers in the top quartile of earnings at the firm, column 5 restricts the sample to workers in an MSA-SIC3 that had a public firm bankruptcy in the previous five years, and column 6 restricts the sample to workers in an MSA-SIC3 that had a public firm bankruptcy in the previous five years. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
LMS * $\Delta Leverage$	-0.008 (0.009)	-0.005 (0.004)	-0.008** (0.004)	-0.009** (0.004)	-0.030* (0.015)	0.003 (0.004)
LMS	-0.002* (0.001)	-0.001 (0.001)	-0.001 (0.000)	0.000 (0.001)	-0.001 (0.002)	-0.001** (0.001)
Sample	Bottom Quartile	2nd Quartile	3rd Quartile	Top Quartile	Bankruptcy Exp	No Bankruptcy Exp
Worker Controls	Earner	Earner	Earner	Earner		
Firm-Year FE	yes	yes	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes	yes	yes
Obs	12,890,500	12,796,700	12,840,100	12,766,000	23,946,900	27,346,400
R-squared	0.19	0.06	0.07	0.10	0.07	0.07

Table 7: Estimates using Subsamples Based on Competitiveness of the Labor Market

This table presents OLS regressions using the change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of labor market size (*LMS*) and the change in firm leverage (Δ *Leverage*). The change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in column 1. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in columns 2 and 3. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Column 1 restricts the sample to workers in MSAs with an unemployment rate greater than 5 percent, column 2 restricts the sample to workers in MSA-industries with an employment HHI greater than 1500, and column 4 restricts the sample to workers in MSA-industries with an employment HHI less than or equal to 1500. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
LMS * Δ Leverage	-0.002 (0.007)	-0.018** (0.007)	0.004 (0.009)	-0.011** (0.005)
LMS	-0.001* (0.001)	0.001 (0.001)	-0.004*** (0.001)	-0.000 (0.001)
Sample	Unemp Rate ≥ 5	Unemp Rate < 5	HHI ≥ 1500	HHI < 1500
Worker Controls	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes
Obs	20,873,900	30,419,400	29,313,500	21,979,800
R-squared	0.07	0.07	0.10	0.06

Table 8: Estimates using Subsamples Based on Firm Growth

This table presents OLS regressions using the change in worker log average quarterly pay as the dependent variable. The key independent variable is the interaction of labor market size (LMS) and the change in firm leverage ($\Delta Leverage$). Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Column 1 restricts the sample to workers at firms whose year $t + 1$ employment was greater than year t employment. Column 2 restricts the sample to workers at firms whose year $t + 1$ employment was less than or equal than year t employment. Column 3 restricts the sample to workers at firms whose year $t + 1$ employment in the MSA was greater than year t employment in the state. Column 4 restricts the sample to workers at firms whose year $t + 1$ employment in the MSA was less than or equal than year t employment in the state. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
LMS * $\Delta Leverage$	0.002 (0.006)	-0.012*** (0.007)	0.004 (0.007)	-0.021*** (0.005)
LMS	-0.001 (0.001)	0.000 (0.001)	-0.003*** (0.001)	0.001 (0.001)
Sample	$\Delta Firm\ Emp > 0$	$\Delta Firm\ Emp \leq 0$	$\Delta Firm-MSA\ Emp > 0$	$\Delta Firm-MSA\ Emp \leq 0$
Worker Controls	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes
Obs	25,453,200	25,840,100	23,795,600	27,497,700
R-squared	0.07	0.07	0.07	0.07

Table 9: Employee Pay, Labor Market Size, and Leverage — Alternate Labor Market Size Measures

This table presents OLS regressions using measures of worker pay as the dependent variable. In columns 1 through 3, the dependent variable is change in worker log average quarterly pay and the sample is restricted to continuing employees. In columns 4 through 6, the dependent variable is worker log average quarterly pay and the sample is restricted to new employees at the firm. The key independent variable is the interaction of labor market size (LMS) and the change in firm leverage ($\Delta Leverage$). In columns 1 and 3, labor market size is measured as the share of MSA employment in the industry. In columns 2 and 4, labor market size is measured as the share of MSA establishments in the industry relative to the national share of establishments in the industry. In columns 3 and 6, labor market size is measured as the share of young firms in the industry relative to the national share of young firms in the industry. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
LMS * (2nd Quartile $\Delta Leverage$)	0.001 (0.002)	0.002 (0.001)	0.006 (0.005)	-0.008 (0.015)	-0.003 (0.020)	-0.010 (0.016)
LMS * (3rd Quartile $\Delta Leverage$)	-0.001 (0.002)	-0.001 (0.002)	-0.002 (0.004)	-0.008 (0.011)	-0.001 (0.018)	-0.007 (0.015)
LMS * (4th Quartile $\Delta Leverage$)	-0.003** (0.002)	-0.003* (0.001)	-0.011*** (0.003)	-0.019** (0.009)	-0.025* (0.015)	-0.021** (0.010)
LMS	-0.006 (0.005)	0.003 (0.002)	0.005 (0.011)	0.016 (0.011)	0.030 (0.021)	0.017 (0.013)
Sample	Continuing Employees			New Employees		
LMS Measure	$\frac{Emp_{klt}}{Emp_{kt}}$	$\frac{\left(\frac{Estab_{klt}}{Estab_{kt}}\right)}{\left(\frac{Estab_{klt}}{Estab_{kt}}\right)}$	$\frac{\left(\frac{YoungFirms_{klt}}{YoungFirms_{kt}}\right)}{\left(\frac{YoungFirms_{klt}}{YoungFirms_{kt}}\right)}$	$\frac{Emp_{klt}}{Emp_{kt}}$	$\frac{\left(\frac{Estab_{klt}}{Estab_{kt}}\right)}{\left(\frac{Estab_{klt}}{Estab_{kt}}\right)}$	$\frac{\left(\frac{YoungFirms_{klt}}{YoungFirms_{kt}}\right)}{\left(\frac{YoungFirms_{klt}}{YoungFirms_{kt}}\right)}$
Worker Controls	yes	yes	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes	yes	yes
Obs	51,293,300	51,293,300	51,293,300	19,551,900	19,551,900	19,551,900
R-squared	0.06	0.06	0.07	0.61	0.61	0.61

Table 10: Robustness: Timing Regressions

This table presents OLS regressions using the change in worker log average quarterly pay as the dependent variable. In column 1, the change is calculated for year $t - 2$ to year $t - 1$, in column 2, it is calculated for year $t - 1$ to t , in column 3, it is calculated for year $t + 1$ to year $t + 2$, and in column 4, it is calculated for year $t + 2$ to year $t + 3$. The key independent variable is the interaction of labor market size (LMS) and the change in firm leverage ($\Delta Leverage$). The change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in column 1. Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in columns 2 and 3. Worker controls include log average quarterly pay and indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
LMS * $\Delta Leverage$	0.002 (0.005)	-0.007 (0.006)	0.002 (0.006)	-0.002 (0.006)
Year	$t - 2$	$t - 1$	$t + 1$	$t + 2$
Firm-Year FE	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes
MSA-Industry FE	yes	yes	yes	yes
Obs	40,419,900	45,590,800	45,028,300	39,601,400
R-squared	0.04	0.07	0.04	0.03

Table 11: Robustness: Labor Productivity, Labor Market Size, and Leverage

This table presents OLS regressions with three dependent variables. The dependent variable in columns 1 and 2 is the change in the firm-MSA value of shipments per worker, and the dependent variable in columns 3 and 4 is the change in the firm-MSA value added per worker. The key independent variable is the interaction of labor market size (*LMS*) and the change in firm leverage (*ΔLeverage*). Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. Worker controls include indicator variables for worker age = 25-34, worker age = 35-44, worker age = 45-54, race, male, high school graduate, and college graduate. Columns 1 and 2 also include log firm-MSA value of shipments per worker, and column 3 and 4 also include log firm-MSA value added per worker. See Appendix Table A1 for variable definitions. The unit of observation is worker-firm-year. The sample is restricted to workers at firms with data in the CMF and ASM. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
LMS * ΔLeverage	-0.003 (0.018)	-0.008 (0.020)	-0.030 (0.030)	-0.030 (0.033)
LMS	-0.002 (0.003)	-0.003 (0.004)	-0.008* (0.005)	-0.008 (0.006)
Dep. Var.		ΔLabor Prod		ΔValue Add per Emp
Worker Controls	yes	yes	yes	yes
Firm-Year FE	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes
MSA-SIC3 FE	yes	yes	yes	yes
Worker FE	no	yes	no	yes
Obs	18,791,000	18,791,000	18,791,000	18,791,000
R-squared	0.89	0.91	0.90	0.92

Table 12: Robustness: Firm-MSA Growth Rates, Labor Market Size, and Leverage

This table presents OLS regressions using firm-MSA growth rates as the dependent variable. The dependent variable in column 1 is employment growth, the dependent variable in column 2 is growth in the number of establishments, the dependent variable in column 3 is sales growth, the dependent variable in column 4 is growth in value added, and the dependent variable in column 5 is growth in capital expenditures. The key independent variable is the interaction of labor market size (*LMS*) and the change in firm leverage (*ΔLeverage*). Labor market size interacted with the change in firm profitability, market-to-book ratio, log sales, asset tangibility, and marginal tax rate are included as controls in all specifications. The initial level of the dependent variable, in logs, is included in each specification. See Appendix Table A1 for variable definitions. The unit of observation is firm-MSA-year. The samples in columns 3 through 5 are restricted to firms with data in the CMF and ASM. Standard errors are adjusted for clustering by firm and are reported in parentheses. *, **, and *** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
LMS * ΔLeverage	0.012 (0.011)	-0.009 (0.007)	-0.002 (-0.223)	-0.027 (-0.801)	-0.012 (-0.287)
LMS	-0.013*** (0.002)	-0.001 (0.001)	-0.002 (-0.697)	-0.010 (-1.274)	-0.007 (-0.733)
Dep. Var.	ΔMSA Emp	ΔMSA Estab	ΔMSA Sales	ΔMSA Value Add	ΔMSA CapEx
Firm-Year FE	yes	yes	yes	yes	yes
MSA-Year FE	yes	yes	yes	yes	yes
MSA-SIC3 FE	yes	yes	yes	yes	yes
Obs	372,300	372,300	29,300	29,300	29,300
R-squared	0.36	0.52	0.54	0.57	0.62